

# Low-Cost, High-Volume Durable Coating Method for Bipolar Plates

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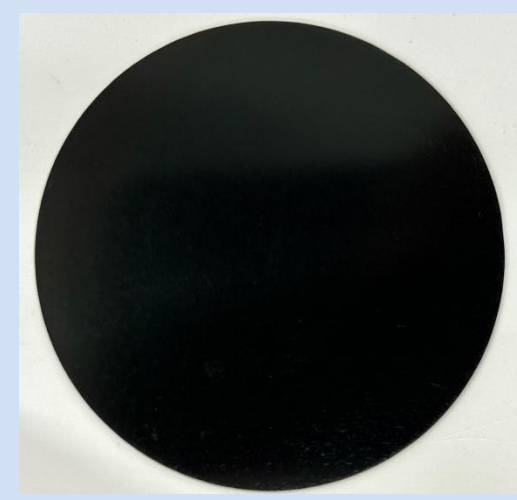
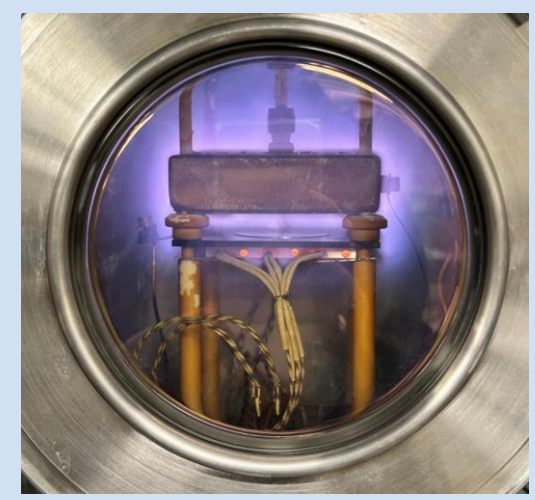
Advanced Cooling Technologies

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## Abstract



- ✓ Good electrical conductivity
- ✓ High corrosion resistance
- ✓ Durable coatings

Plasma-enhanced chemical vapor deposition (PECVD) is used to coat stainless steel substrates using metal/carbon coatings to form highly conductive, corrosion-resistant, and durable coatings to use this technology in coating bipolar plates used in the hydrogen fuel cells for various applications such as automotive industry, energy sector, and commercial and residential users

## Approach

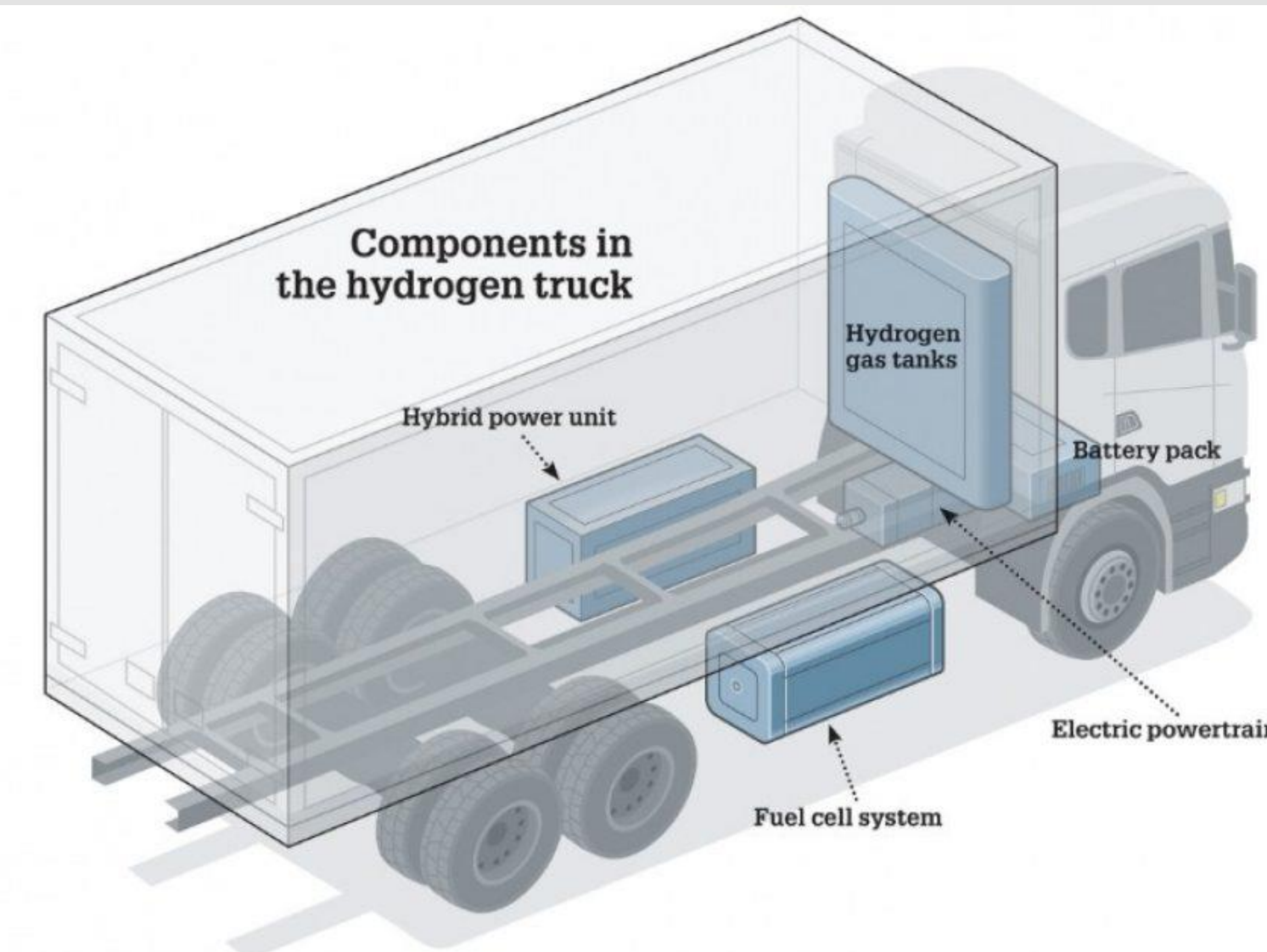
Development of PECVD coating for bipolar plates of H<sub>2</sub> fuel cells with:

- Good electrical conductivity
- High corrosion resistance
- Durable coatings

a-C layer  
Interface a-C layer  
Ti<sub>x</sub> transition layer  
Ti Seedlayer  
SS Substrate



## Potential Impact



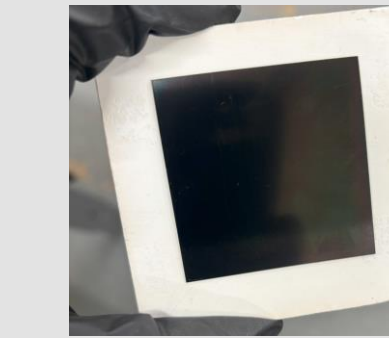
- Accelerating Clean Energy Adoption
- Domestic Manufacturing and Job Creation
- Energy Security and Resilience
- Economic Competitiveness
- Technology Transfer Opportunities

## Accomplishments and Progress

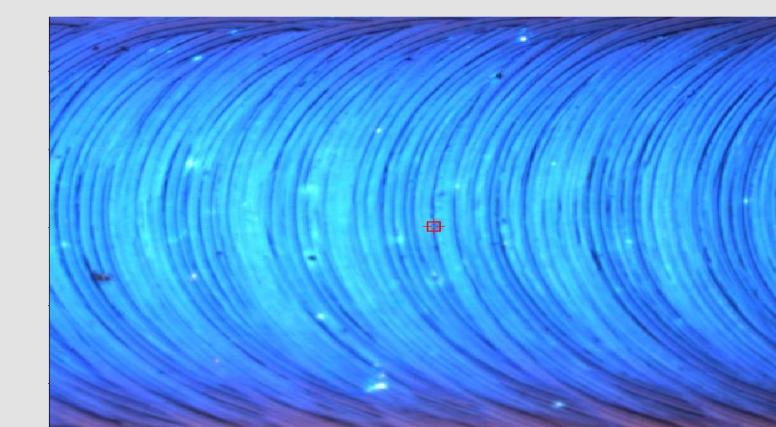
Designed and developed PECVD coating system



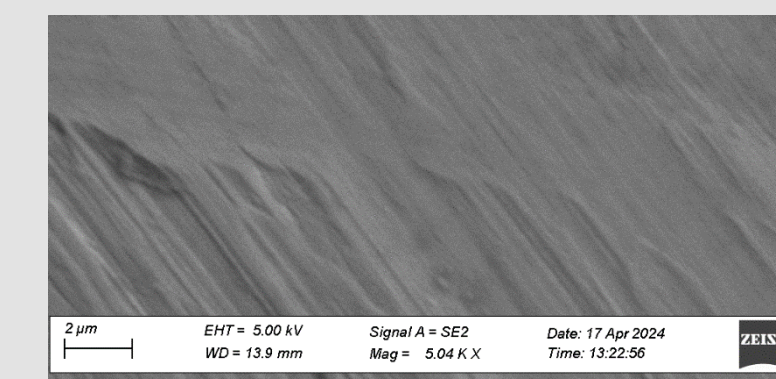
Demonstration of uniform carbon coatings on stainless steel substrates



Fabricating high-quality coatings with desired composition



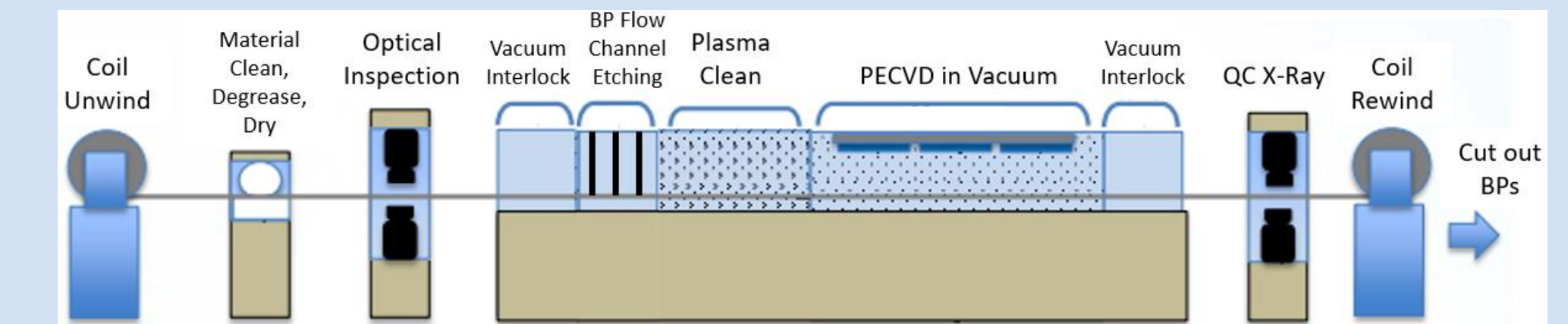
- High-quality crystalline graphite/graphene coatings:
- Sharp peaks
  - No amorphous
  - No oxides



Pinhole-free electrically conductive coatings

Development and successful demonstration of novel power supply

## Commercialization



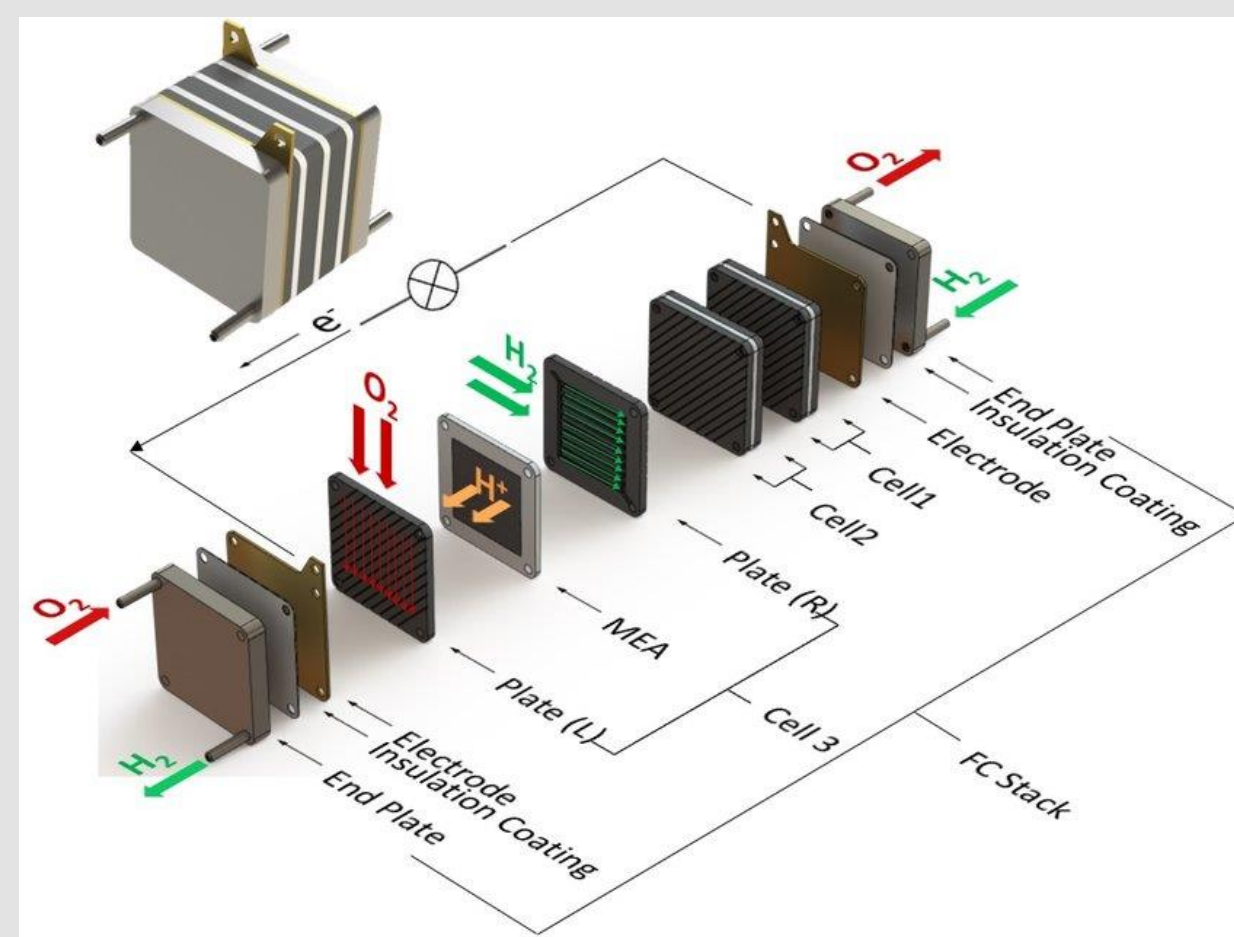
Scale up efforts to meet DOE targets

New Power supply – Burst mode (highly energy efficient)

## Project Introduction

### H<sub>2</sub> fuel cell Metal Bipolar plate (BP) Coating/ refurbishment

- Novel and innovative concepts to address challenges scaling high quality and protective coats for bipolar plates (BPPs) or refurbishment of such coated BPPs
- Corrosion, resistant lower cost base metal coatings, increase manufacturing capacity to get 20,000 stacks/year target, key challenges include scaling of manufacturing
- Coating/treatment high quality and uniformity, maintaining requisite properties conductivity and durability.
- Refurbishment: methods including circularity concepts for these BPPs, how to accomplish, coating or refurbishment tech, prototype scale, increase mfg throughput, near term capacity or target.



## Acknowledgment

- 1) DOE Phase I SBIR, Award # DE-SC0023833

## References

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- 2) Strategic Analysis Inc.
- 3) Bipolar Plate Workshop Report, Argonne National Lab (2017).
- 4) <https://www.scania.com/group/en/home/newsroom/news/2020/how-does-a-hydrogen-fuel-cell-electric-truck-work.html>